The D0 Level 3
Data Acquistion System
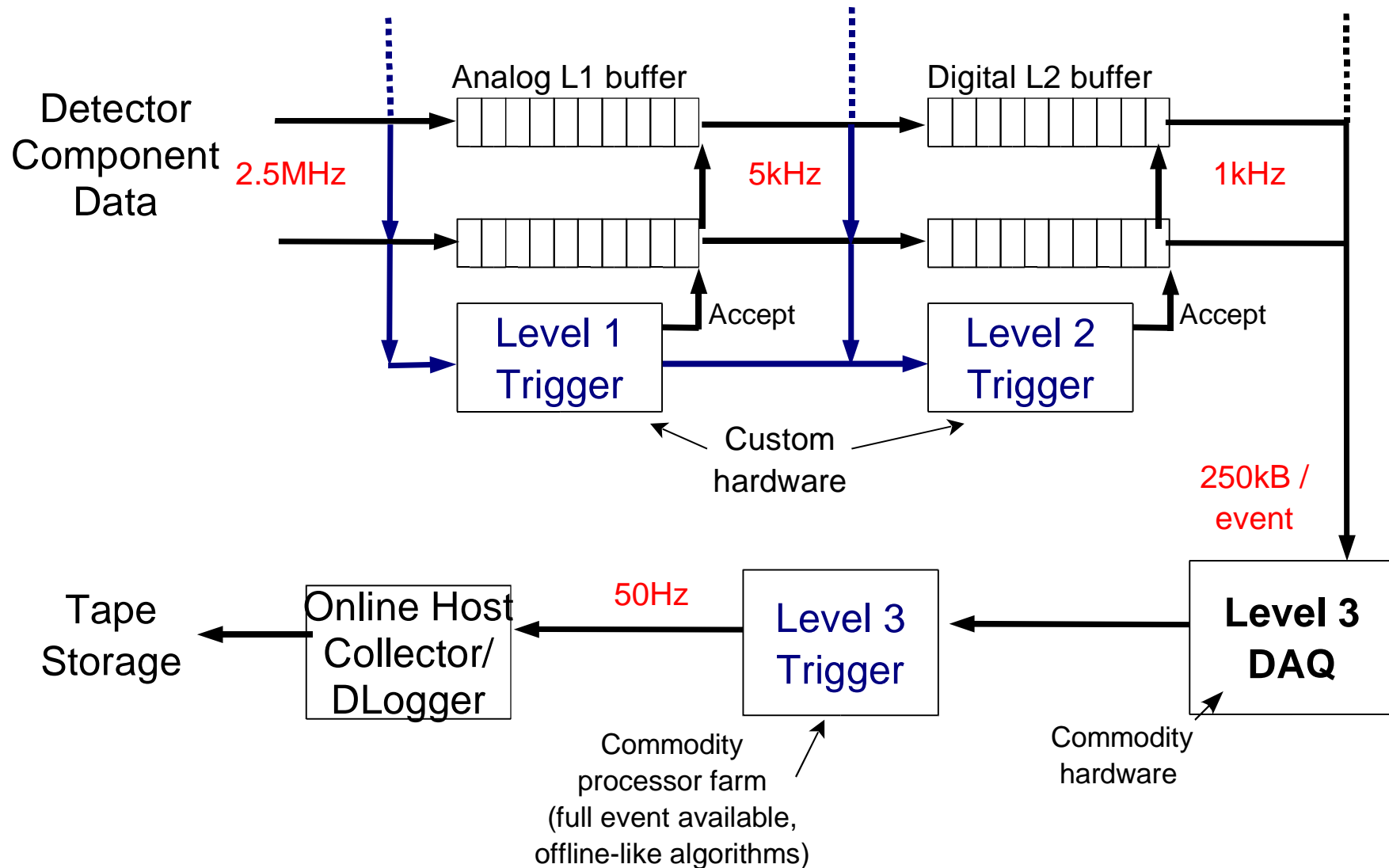
Doug Chapin
Brown Univsersity
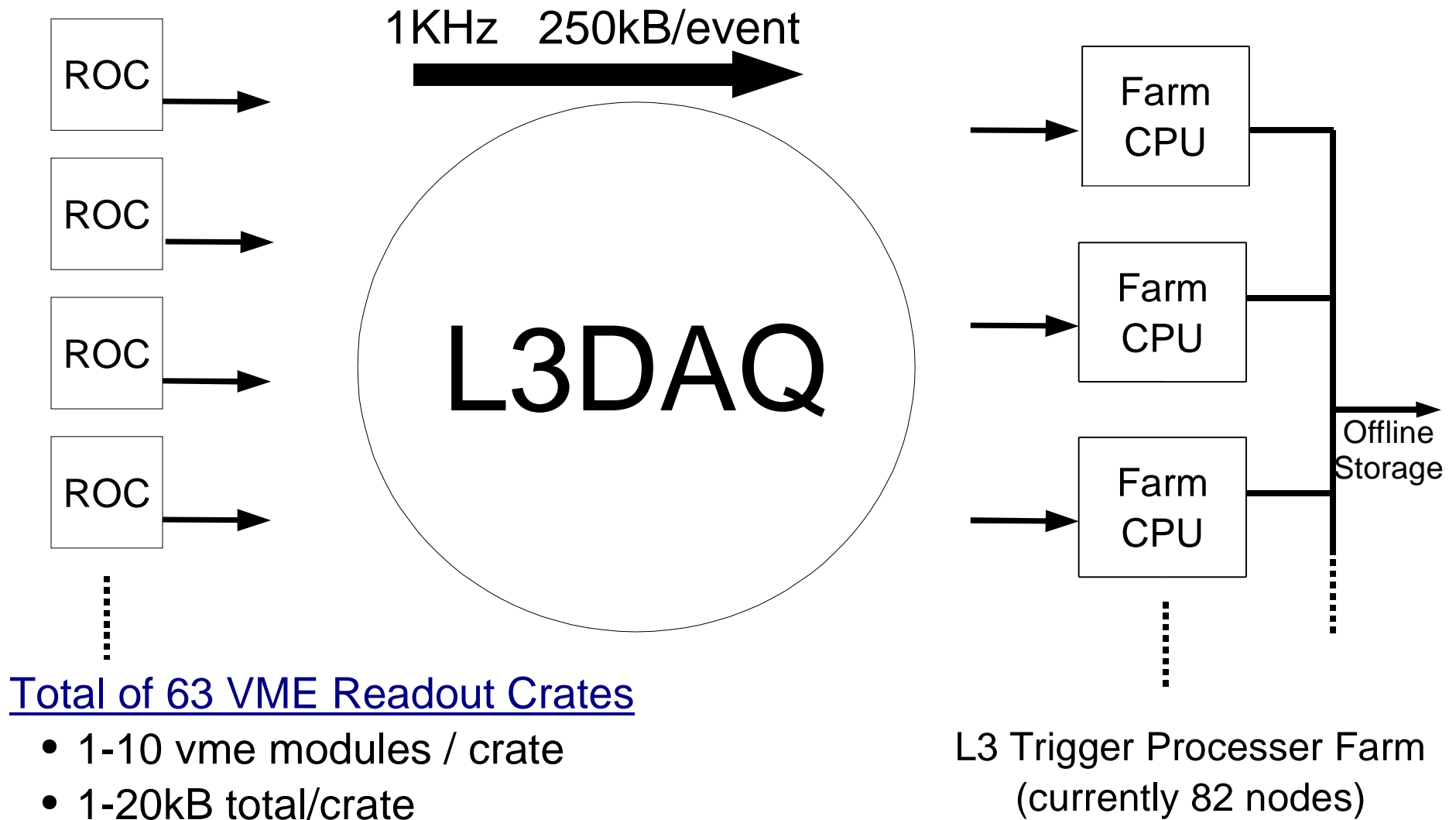
For the D0 L3DAQ Group
Brown University
University of Washington
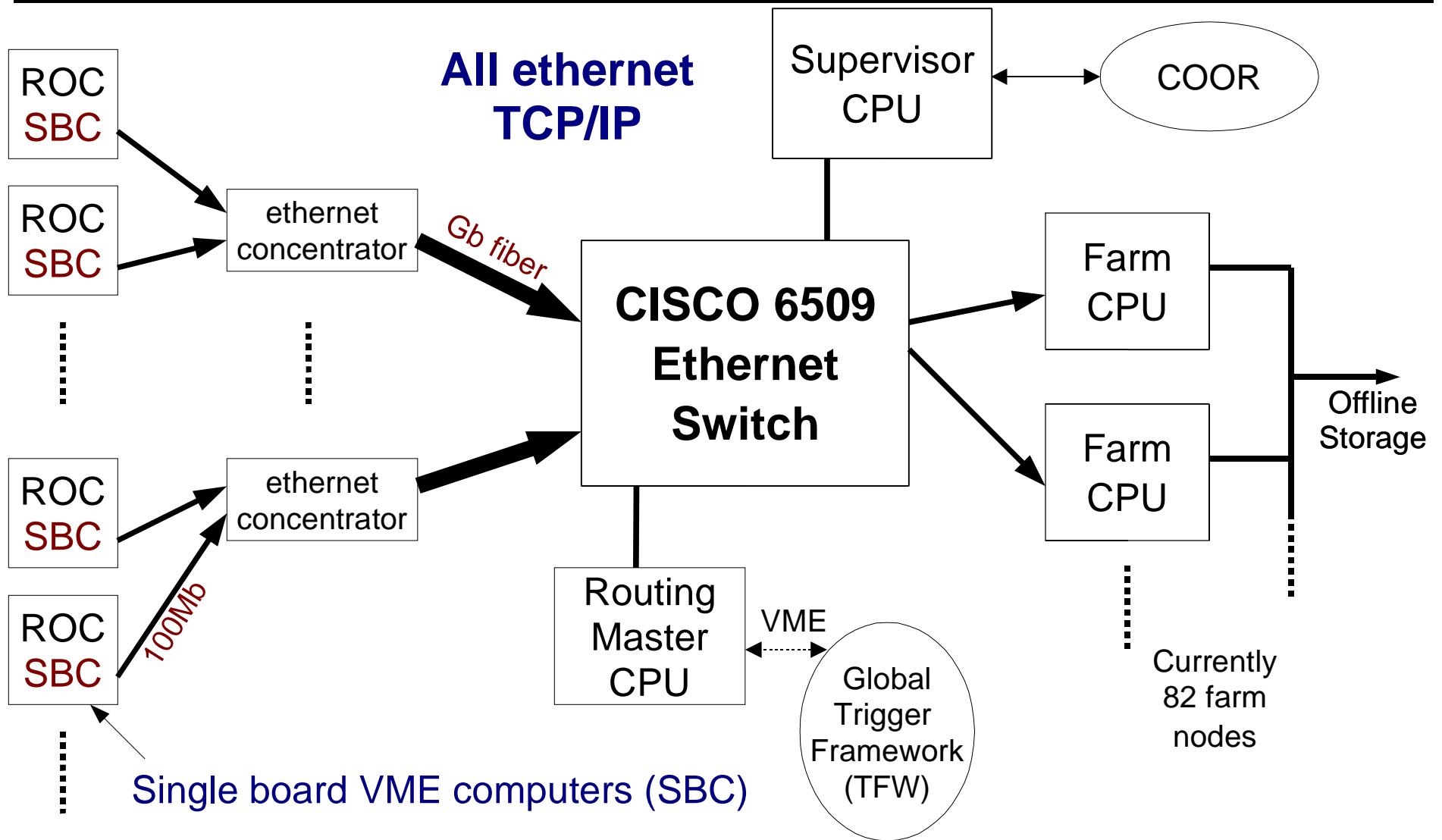
D0 Data Acquisition System

Detector Component Data

2.5MHz

Analog L1 buffer

Level 1 Trigger

5kHz

Accept

Custom hardware

Digital L2 buffer

Level 2 Trigger

1kHz

Accept

250kB / event

Level 3 DAQ

Commodity hardware

50Hz

Level 3 Trigger

Commodity processor farm (full event available, offline-like algorithms)

Online Host Collector/ DLogger

Tape Storage

L3DAQ Requirements

ROC

ROC

ROC

ROC

1KHz   250kB/event

L3DAQ

Farm CPU

Farm CPU

Farm CPU

Offline Storage

Total of 63 VME Readout Crates

- 1-10 vme modules / crate
- 1-20kB total/crate

L3 Trigger Processer Farm
(currently 82 nodes)

Commodity-Based System

ROC SBC

ROC SBC

ROC SBC

ROC SBC

ethernet concentrator

ethernet concentrator

All ethernet TCP/IP

Gb fiber

100Mb

Single board VME computers (SBC)

CISCO 6509 Ethernet Switch

Supervisor CPU

COOR

Routing Master CPU

VME

Global Trigger Framework (TFW)

Farm CPU

Farm CPU

Offline Storage

Currently 82 farm nodes

Communication Flow

Features
- Backpressure through TFW interface
- Multiple simultaneous runs (D0 requirement)
- Farmnode degeneracy

Software
- Linux
- TCP/IP implemented via ACE communication and utility library
  - Open and multi-platform
- All commodity hardware

SBCs → Event Fragments → Farm

Farm → Offline Storage

Routing Info

Crate lists

Free buffers

Trigger Programming

Routing Master

Super-visor

Run Info

TFW

Run Control
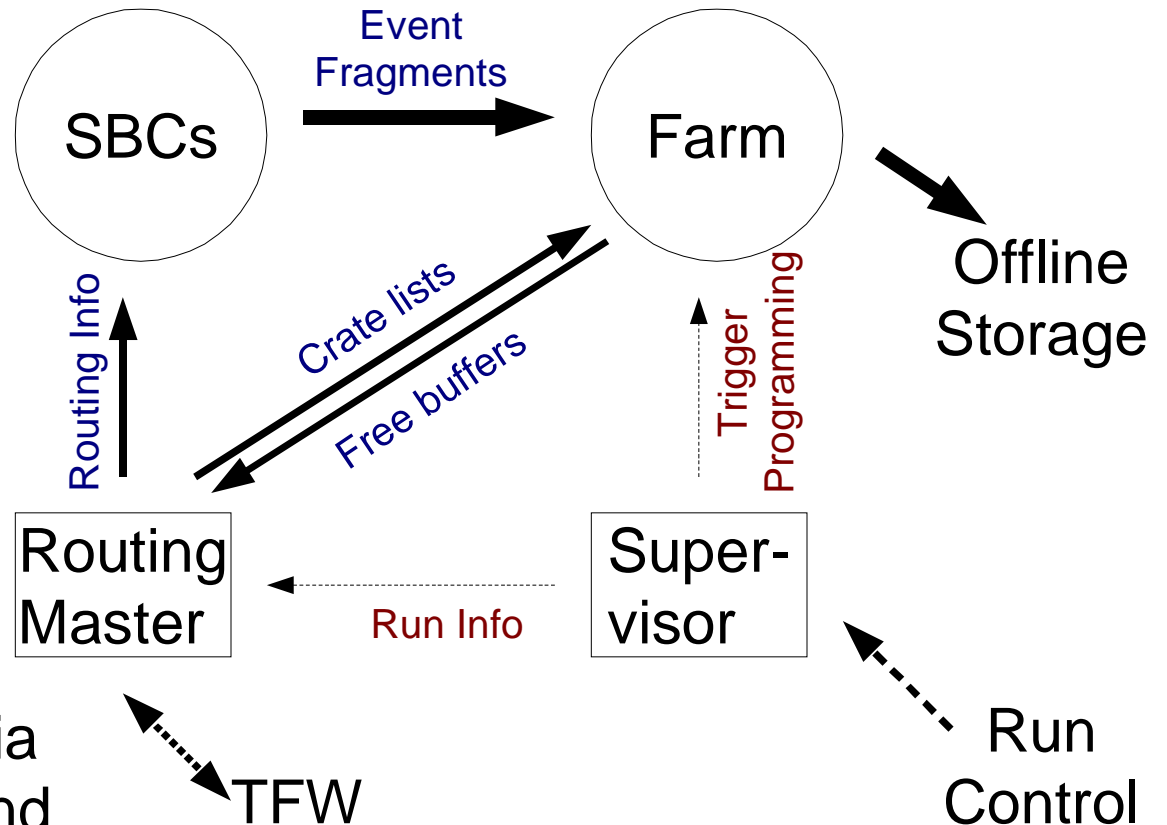
Network Switch and Farmnodes

Network

- CISCO 6509
  - One Gb fiber module (16 ports)
  - Two 48-port 100Mb modules
- Concentrators in MCH
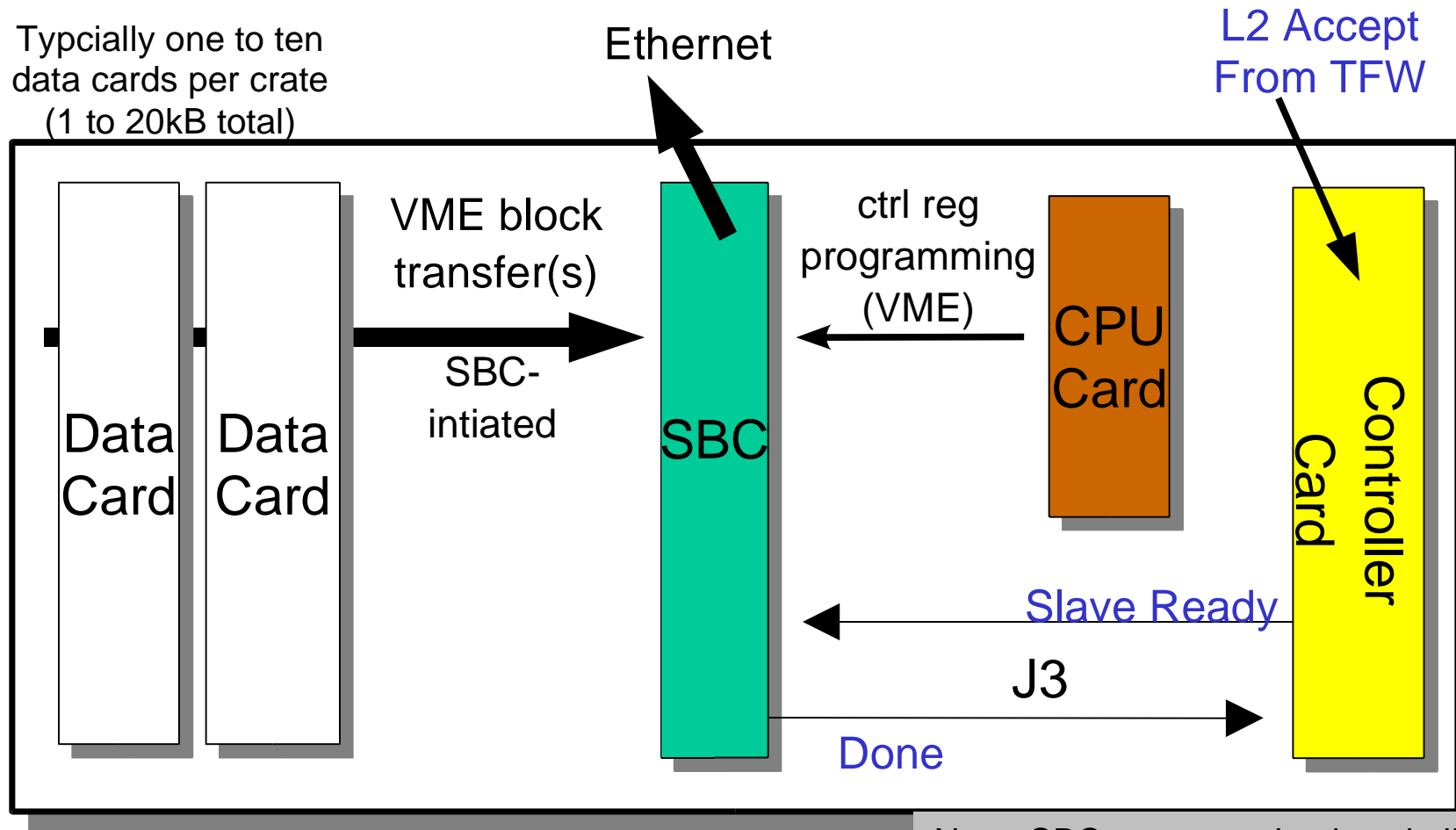 - 100Mb -> Gb fiber
  - 100Mb/s ethernet in SBCs
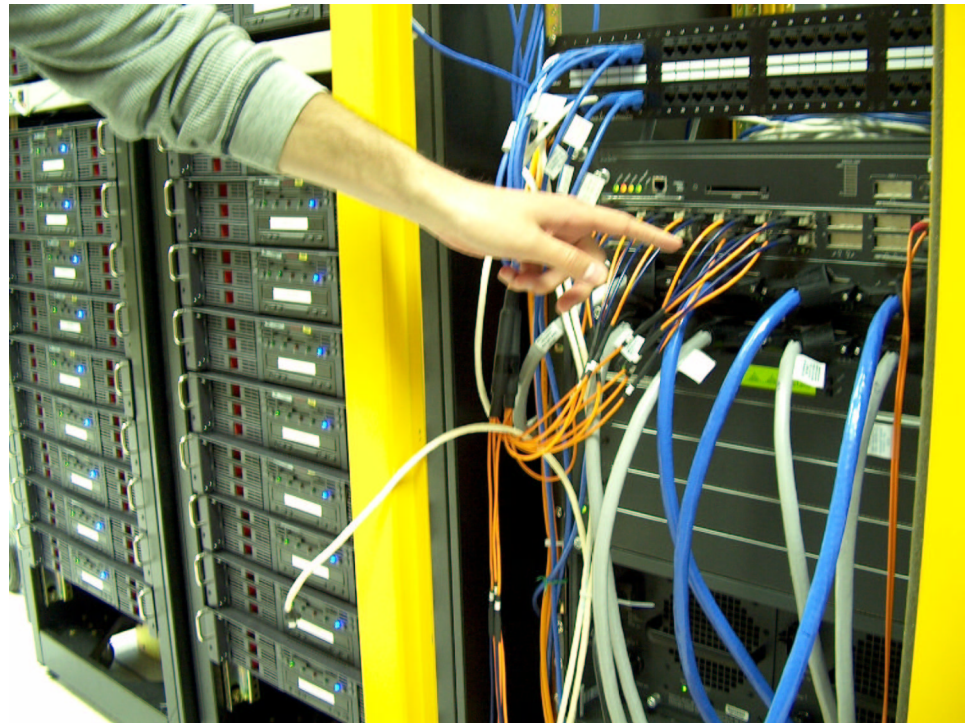
Farmnodes

- Dual Processor
  - AMD 2000 and PIII 1GHz flavors
- Dual ethernet (100MB/s)
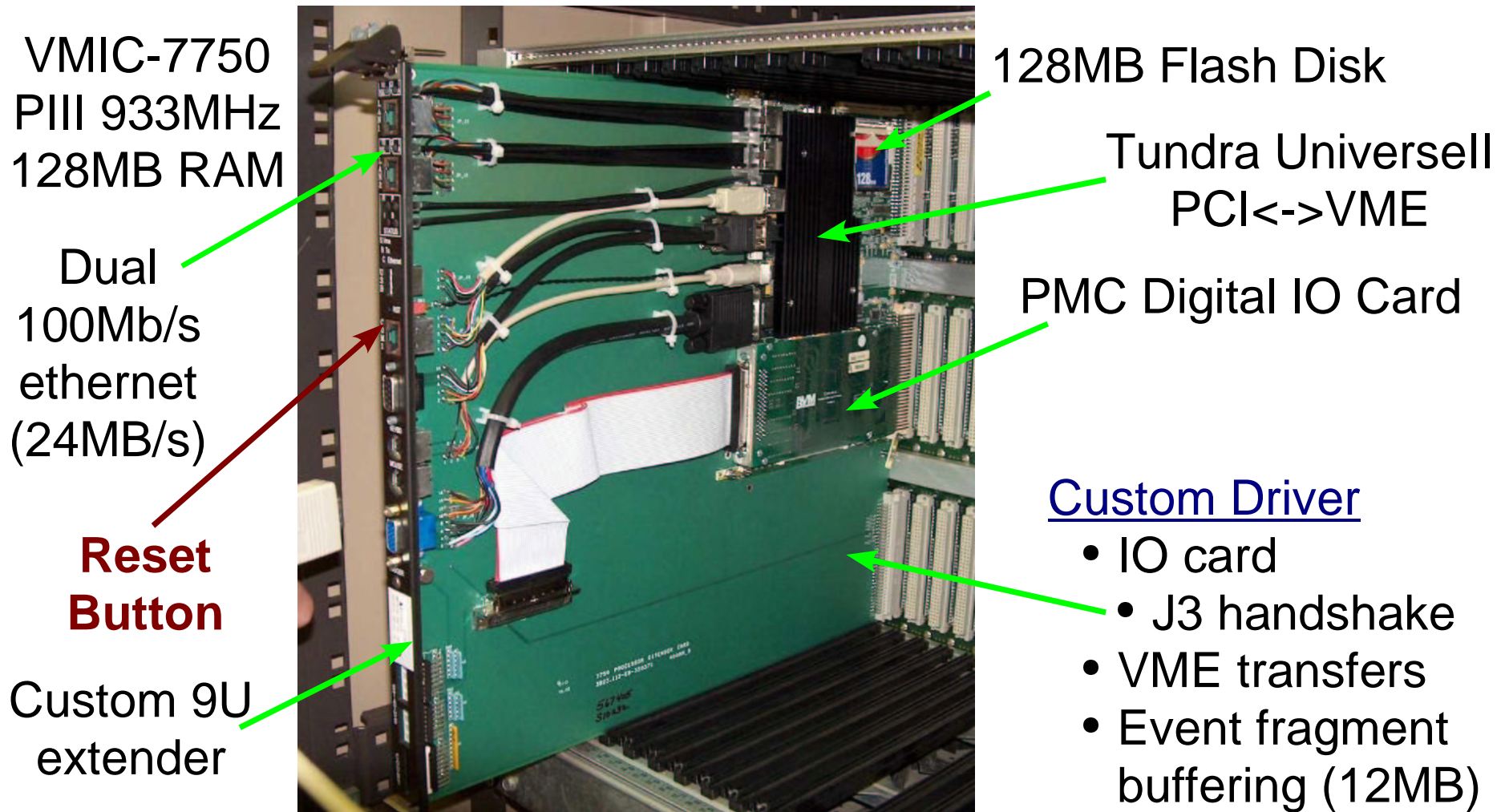
Note: farmnodes are located in FCH2

VME Readout Crate

Typcially one to ten
data cards per crate
(1 to 20kB total)

Ethernet

L2 Accept
From TFW

VME block
transfer(s)

SBC-
intiated

ctrl reg
programming
(VME)

Data Card

Data Card

SBC

CPU Card

Controller Card

Slave Ready

J3

Done

Note: SBC programming is volatile!
After a reboot, ctrl reg programming
is needed for some crates:
reinit VME (CFT,SMT,L1CAL)
start_readout (MUO)

• Data card, CPU, and Controller
cards specific to crate type

Single Board Computer

VMIC-7750
PIII 933MHz
128MB RAM

Dual
100Mb/s
ethernet
(24MB/s)

**Reset
Button**

Custom 9U
extender

128MB Flash Disk

Tundra UniverseII
PCI<->VME

PMC Digital IO Card

<u>Custom Driver</u>
- IO card
  - J3 handshake
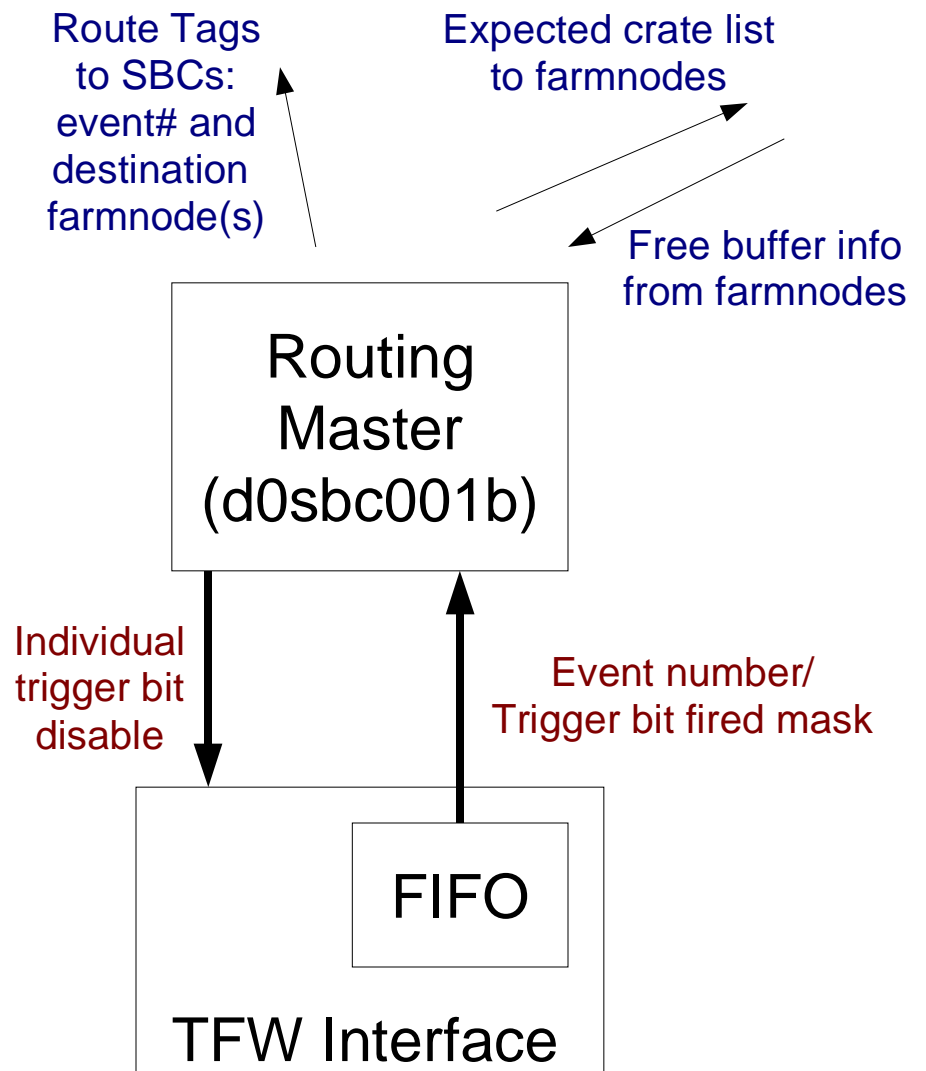- VME transfers
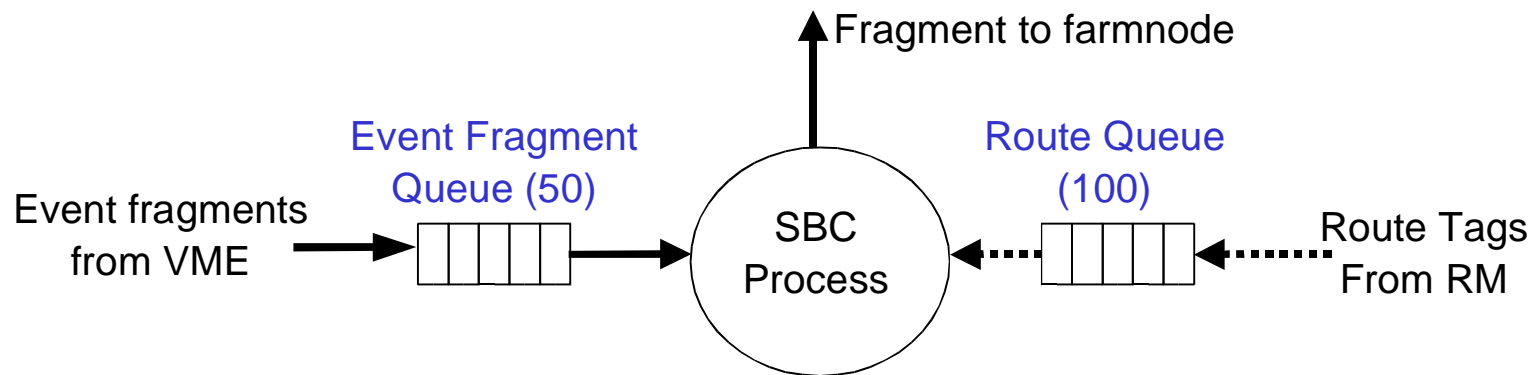- Event fragment
  buffering (12MB)

Routing Master

Operation

- Dedicated SBC
- Routing decision
  - Based on run configuration and L2 trigger decision
  - Sent to SBCs and target nodes
- Apply backpressure to TFW when too few farmnode buffers (L3 Disable)

Note: RM SBC is located in MCH1 Rack 100

Route Tags to SBCs: event# and destination farmnode(s)

Expected crate list to farmnodes

Free buffer info from farmnodes

Routing Master (d0sbc001b)

Individual trigger bit disable

Event number/ Trigger bit fired mask

FIFO

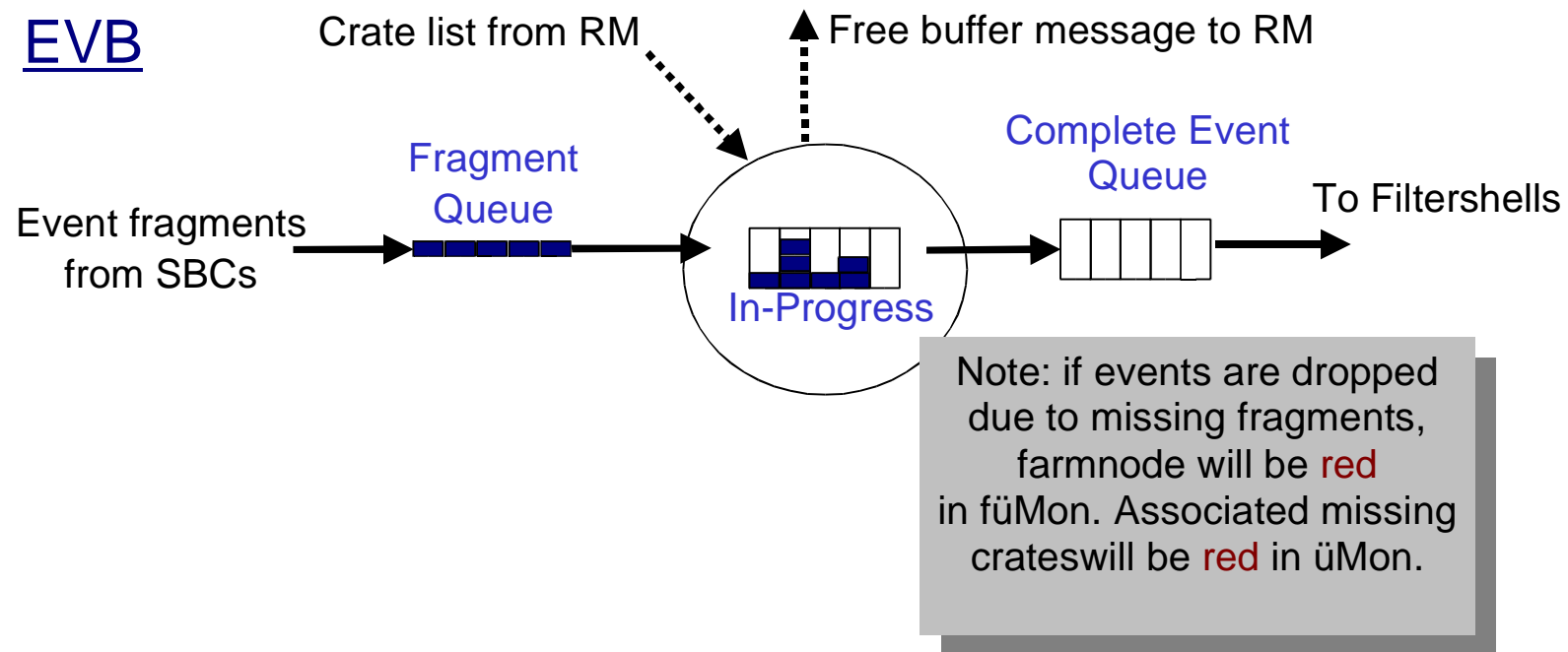TFW Interface

SBC Operation

SBC process
- Compare head event frag with head route tag
  - send fragment if transfer number matches
  - otherwise drop fragment or route tag (automatic resync)
- Sent fragments are buffered (in TCP send window)
  - fragments dropped if no connection to farmnode

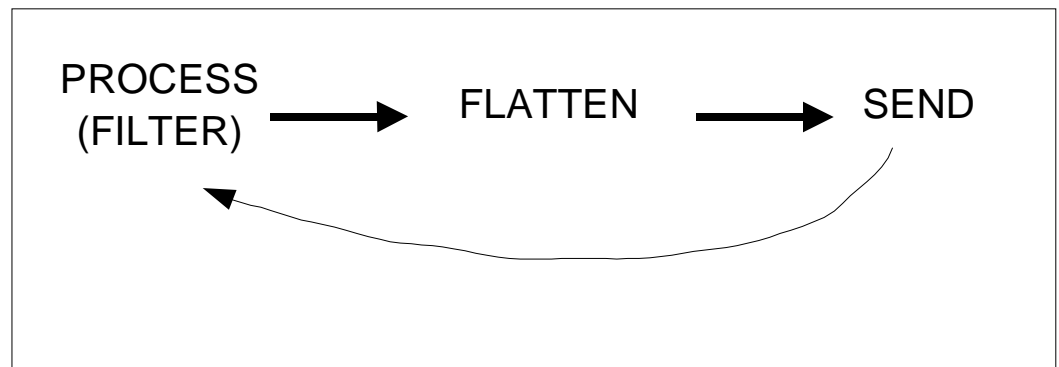Note: mismatched transfer numbers typically indicate a problem upstream of the SBC.
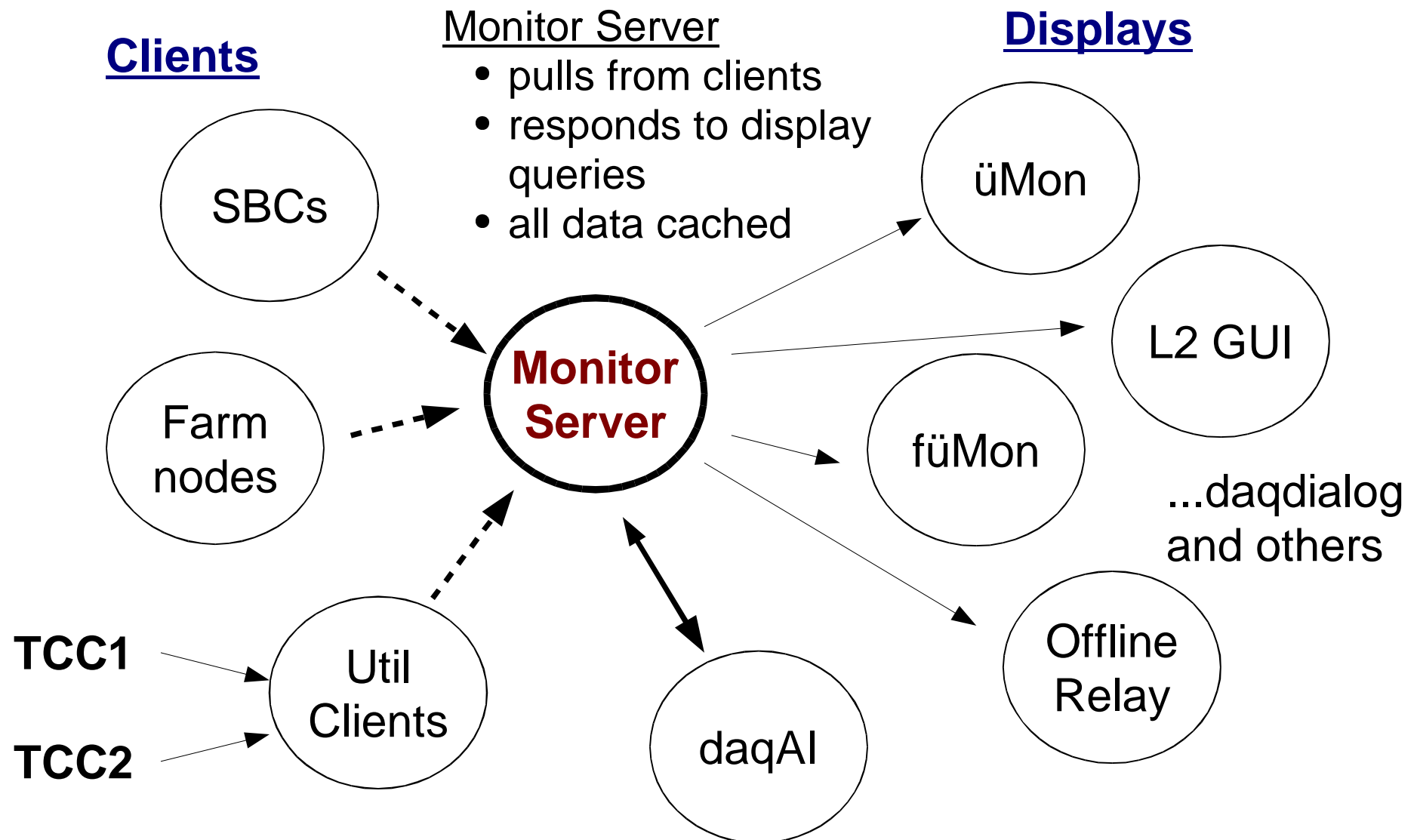
Event Builder and Filtershell

EVB

Crate list from RM

Free buffer message to RM

Fragment
Queue

Complete Event
Queue

Event fragments
from SBCs

To Filtershells

In-Progress

Note: if events are dropped
due to missing fragments,
farmnode will be red
in füMon. Associated missing
crateswill be red in üMon.

Filtershell (Scriptrunner)
- Two processes per node
- Each processes one
  event at a time

PROCESS
(FILTER)
FLATTEN
SEND

Monitoring

Clients

Monitor Server
- pulls from clients
- responds to display queries
- all data cached

Displays

SBCs

Farm nodes

Monitor Server

üMon

L2 GUI

füMon

...daqdialog and others

TCC1

TCC2

Util Clients

daqAI

Offline Relay

uMon v2.6.00

dzero **Data Acquisition Über Monitor**

L3 Input Rate
384 Hz

Routing Group 0

Input: 369 Hz

Disable: 0.0%

Total EVB Rate
369 Hz

Super Status: Ready

Data Refresh

L3 Input/Incomplete Event Rate
(1 KHz Scale)

1 KHz Scale ▶

10:27:40 PM

9:56:01 PM
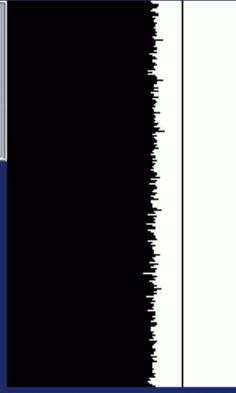
L3 Input Rate By Bit

10 Hz Scale ▶

Bit 0: 0.3 Hz
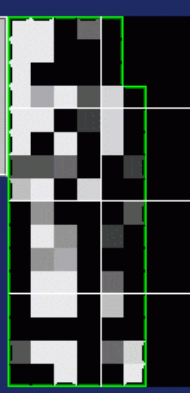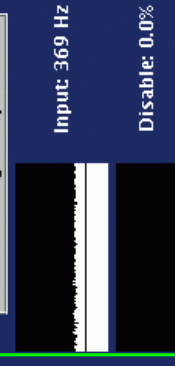
Route FIFO Depth

RM-Farm conn

Global L3 Disable: 0.0%

EVB Rates

10 Hz Scale ▶
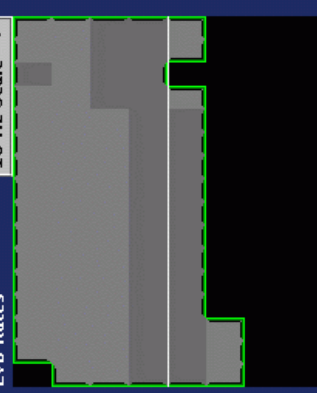
Node 25: 4.7 Hz

Help

Reset Inc Counters

UNreset Inc Counters

0x10 Inc%:0
0x11 Inc%:0
0x12 Inc%:0
0x13 Inc%:0

0x14 Inc%:0
0x16 Inc%:0
0x17 Inc%:0
0x18 Inc%:0

0x19 Inc%:0
0x1f Inc%:0

0x20 Inc%:0
0x21 Inc%:0
0x22 Inc%:0
0x23 Inc%:0

0x24 Inc%:0
0x25 Inc%:0

0x30 Inc%:0
0x31 Inc%:0
0x32 Inc%:0
0x33 Inc%:0

0x34 Inc%:0
0x35 Inc%:0
0x36 Inc%:0
0x37 Inc%:0

0x38 Inc%:0
0x39 Inc%:0
0x3a Inc%:0
0x3b Inc%:0

0x40 Inc%:0
0x41 Inc%:0
0x42 Inc%:0
0x43 Inc%:0

0x44 Inc%:0
0x45 Inc%:0
0x46 Inc%:0
0x47 Inc%:0

0x48 Inc%:0
0x49 Inc%:0
0x4a Inc%:0
0x4b Inc%:0

0x4c Inc%:0

0x50 Inc%:0
0x51 Inc%:0
0x52 Inc%:0
0x53 Inc%:0

0x60 Inc%:0
0x61 Inc%:0
0x62 Inc%:0
0x63 Inc%:0

0x64 Inc%:0
0x65 Inc%:0
0x66 Inc%:0
0x67 Inc%:0

0x68 Inc%:0
0x69 Inc%:0
0x6a Inc%:0
0x6b Inc%:0

0x70 Inc%:0
0x71 Inc%:0
0x72 Inc%:0
0x73 Inc%:0

0x74 Inc%:0
0x75 Inc%:0
0x79 Inc%:0
0x9 Inc%:0

üMon Details

Farmnode
Connections

Connection issues. Depending on number of bad connection, restart/reboot SBC or restart farmnode processes

VME event
rate

Route Queue
Depth

0x66
Inc%:0

Event Queue
Depth

Yellow block at top of strip chart: No monitor information available.

Note: Full route queue AND empty event queueis typically a component readout problem.

0x79
Inc%:0

fuMon v1.0.01

1 Run
Run 176930

10Hz

CPU Utilization

0 20 40 60 80 100

Out/Pass (Reject)

100Hz

36Hz/10% (9.6)

L3DAQ Farm Über Monitor

dzero

Node 16 Details

Run 176930   CPU: 35%
In: 4.3Hz   IP: 0   AD: 3
Out: 0.3Hz   COM: 0   FB: 20
<188k>   EQ: 0
               FS[0]   FS[1]
Total   54333   54331
Failed   49441   49513
Passed   4892   4818
Sent   4892   4818
SendErr   0   0
StopReqs   8   8
Restarts   9   9
Exits   0   0
State   WAIT   WAIT

Refresh <5.1s>

füMon Details

Filtershell States

EVB Input Rate

Advertised Buffers

Filtershell Pass Fraction

Missing fragment(s)

WAIT

FILTERING

FLATTEN

In Progress

Complete

SEND

Stuck Sending to Collector
- Collector problem?
- event size too big?
- output rate too high?
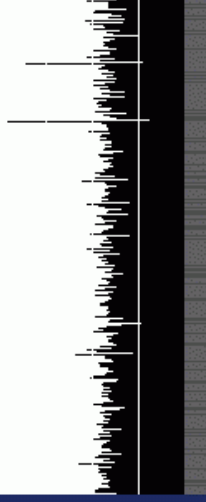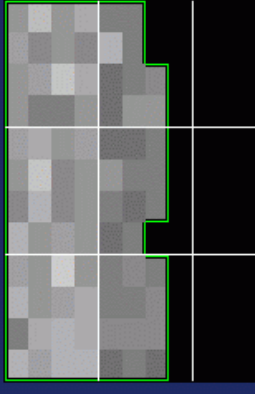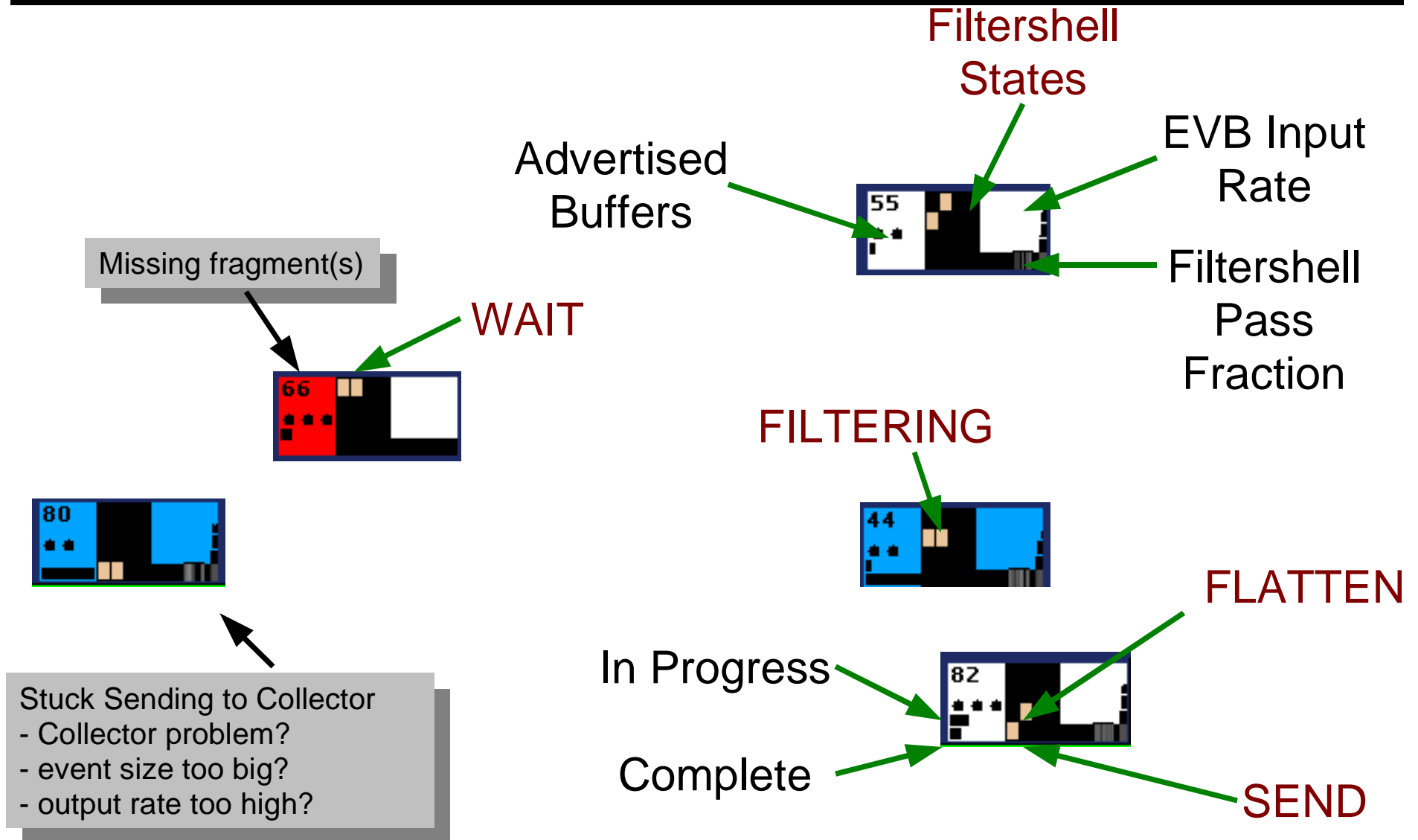
SBC Hammers

Small hammer
- restart SBC processes
  - via SBC manager
  - or command line: l3xdaq_reset x52

Note: the RM is also an SBC. Reset it with "l3xdaq_reset RM" or "l3xdaq_reset d0sbc001b"

Medium hammer
- soft reboot of SBC
  - via SBC manager
  - or command line: l3xdaq_reboot x52

Big hammer
- hard reboot
  - press RST button on SBC

SBC Manager - Mozilla

File   Edit   View   Go   Bookmarks   Tools   Window   Help

Back   Forward   Reload   Stop   http://www-d0ol.fnal.gov/www/groups/l3daq/manager/sbc_manager.php   Print

SBC Manager Home
Node Manager Home

SBC Manager

L3DAQ Home
Logfiles

CLEAR | ALL | L1 | L2 | MUO | CAL | CFT | SMT | STT

Routing Master

☐ **RM** (d0sbc001b)

L1

☐ **0x10** (d0sbc018b) ☐ **0x11** (d0sbc072b) ☐ **0x12** (d0sbc075b) ☐ **0x13** (d0sbc031b)
☐ **0x14** (d0sbc077b) ☐ **0x16** (d0sbc039b) ☐ **0x17** (d0sbc014b) ☐ **0x18** (d0sbc073b)
☐ **0x19** (d0sbc074b) ☐ **0x1f** (d0sbc008b)

L2

☐ **0x20** (d0sbc033b) ☐ **0x21** (d0sbc027b) ☐ **0x22** (d0sbc028b) ☐ **0x23** (d0sbc017b)
☐ **0x24** (d0sbc078b) ☐ **0x25** (d0sbc025b)

MUO

☐ **0x30** (d0sbc040b) ☐ **0x31** (d0sbc024b) ☐ **0x32** (d0sbc038b) ☐ **0x33** (d0sbc044b)
☐ **0x34** (d0sbc012b) ☐ **0x35** (d0sbc059b) ☐ **0x36** (d0sbc023b) ☐ **0x37** (d0sbc026b)
☐ **0x38** (d0sbc045b) ☐ **0x39** (d0sbc011b) ☐ **0x3a** (d0sbc021b) ☐ **0x3b** (d0sbc015b)

CAL

☐ **0x40** (d0sbc070b) ☐ **0x41** (d0sbc060b) ☐ **0x42** (d0sbc062b) ☐ **0x43** (d0sbc071b)
☐ **0x44** (d0sbc030b) ☐ **0x45** (d0sbc022b) ☐ **0x46** (d0sbc035b) ☐ **0x47** (d0sbc036b)
☐ **0x48** (d0sbc067b) ☐ **0x49** (d0sbc020b) ☐ **0x4a** (d0sbc068b) ☐ **0x4b** (d0sbc046b)
☐ **0x4c** (d0sbc013b)

CFT

☐ **0x50** (d0sbc006b) ☐ **0x51** (d0sbc064b) ☐ **0x52** (d0sbc032b) ☐ **0x53** (d0sbc065b)

ACTION

Echo Test

Grab TRACE

Get Info

Get Configuration

Medium Hammer

Reboot!

Stop Processes

Restart Processes

Small Hammer

Done

Farmnode Hammers

Small hammer
- Restart farmnode processes
  - via Node Manager
  - or command line: l3xreset 04

Medium hammer
- Stop farmnode processes
  - via Node Manager
  - or command line: l3xstop 04

Big hammer
- Power off farmnode (in FCH2)
  - use power button on front of node
  - unplug the power cord if needed

Note: the Supervisor can get confused by a misbehaving farmnode. After the farmnode has been taken down, a PAUSE/RESUME of the run may be needed for the Supervisor to realize that the farmnode is gone.

Other Hammers

Supervisor
- Restart supervisor process (runs on d0lxmast)
- command line: start_daq l3supervisor

Monitor Server
- Restart monitor server process
  - command line: start_daq l3ms

Monitor Server Utils
- Support programs for L2 GUI, daqdialog, and daqAI
  - command line: start_daq l3ms_util_clients

Note: problems with Monitor Server Utils historically follow an L2 software upgrade

Resources

L3DAQ webpage

http://www-d0ol/www/groups/l3daq/

- üMon and füMon documentation
- What-to-do-When
  - common problems and solutions
- Node and SBC manager pages
- SBC and Supervisor Logfiles
- On-call list

L3DAQ Experts

- Doug Chapin, Gordon Watts,
  Aran Garcia-Bellido, Thomas Gadfort
- Phone us!
  - even with general üMon or füMon questions

Template

- Text